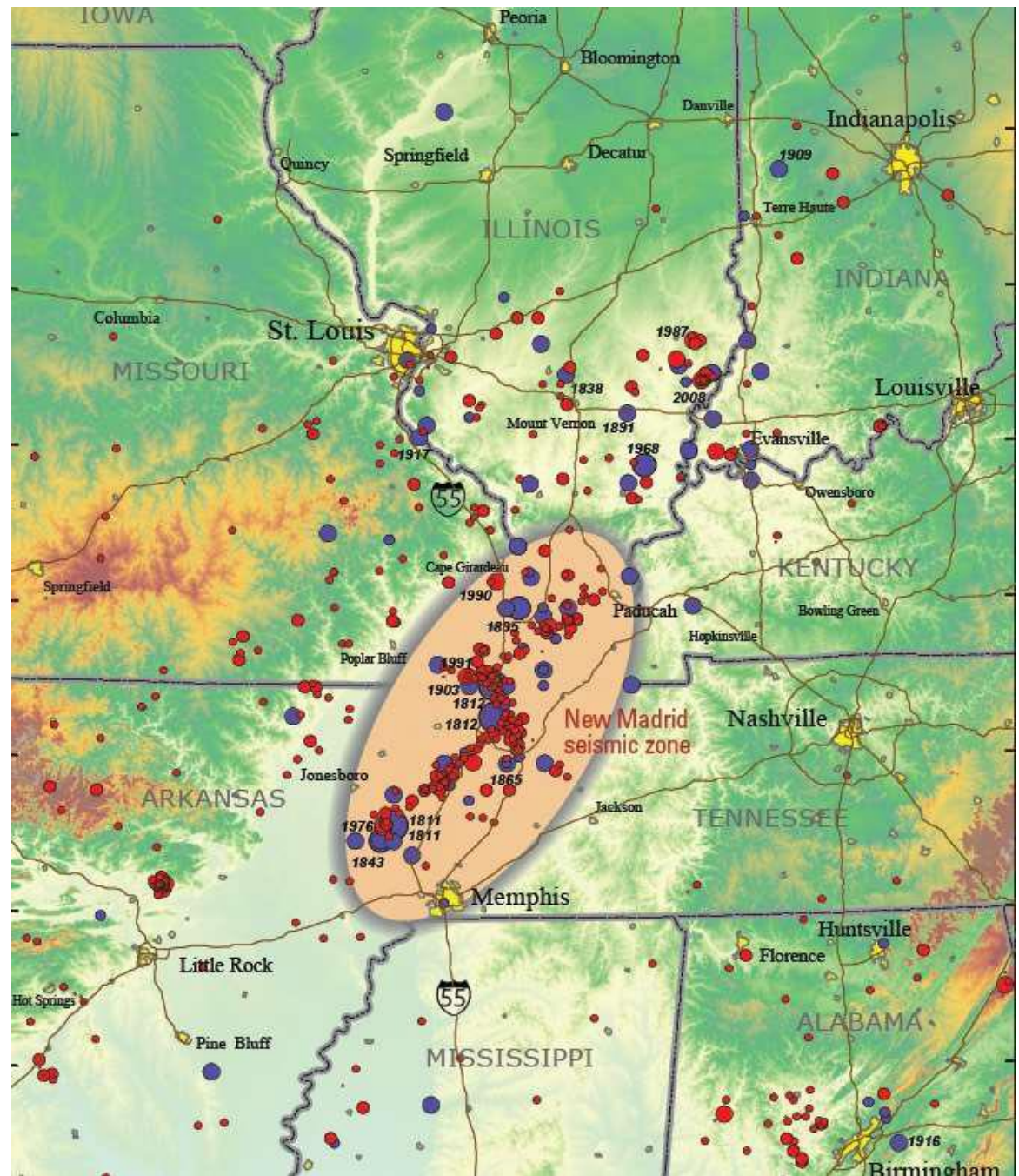
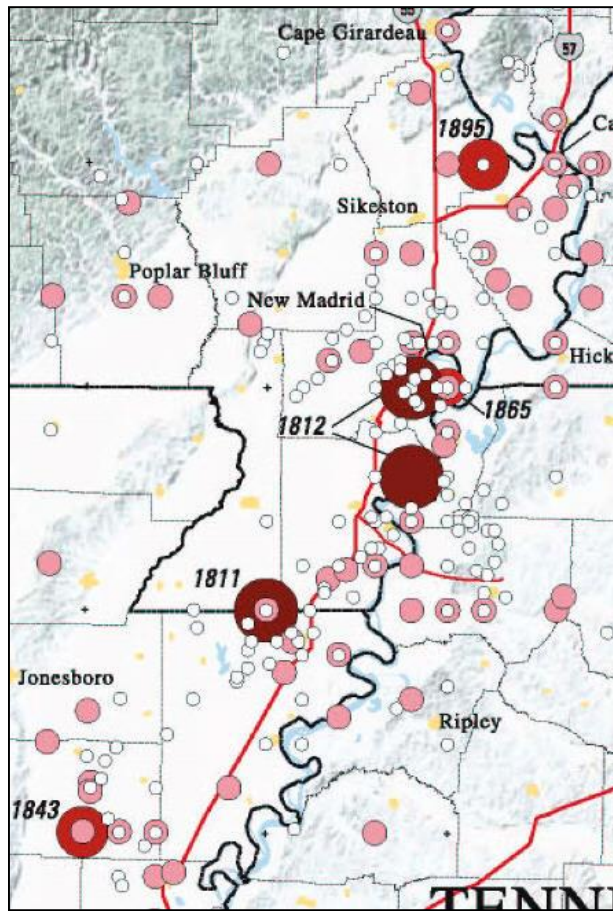


# New Madrid Seismic Zone

About 200 earthquakes per year



# Danger in the Central U.S.: New Madrid Seismic Zone



Winter of 1811-12

New Madrid area shaken by some of the strongest earthquakes in U.S. history (estimated to have been magnitude 7 to 8)

- Damage reported as far away as Charleston, South Carolina, and Washington, D.C.
- Shaking was felt over 5,000,000 square kilometers.



# Earthquakes:

## The Great New Madrid Earthquakes

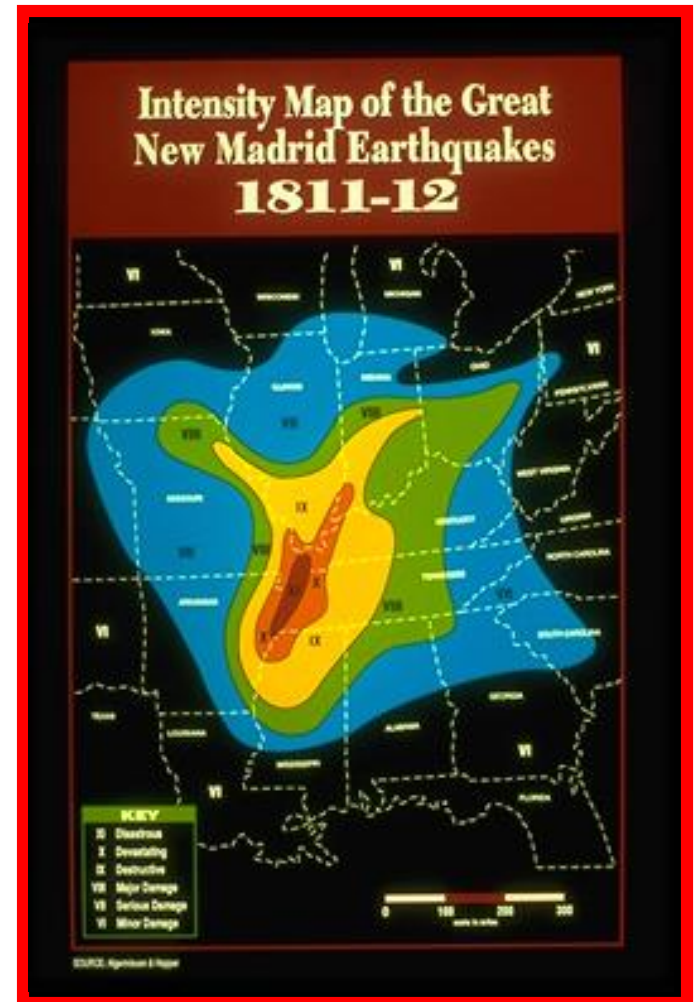
-Widespread Effects from  
the 1811-12 earthquakes–

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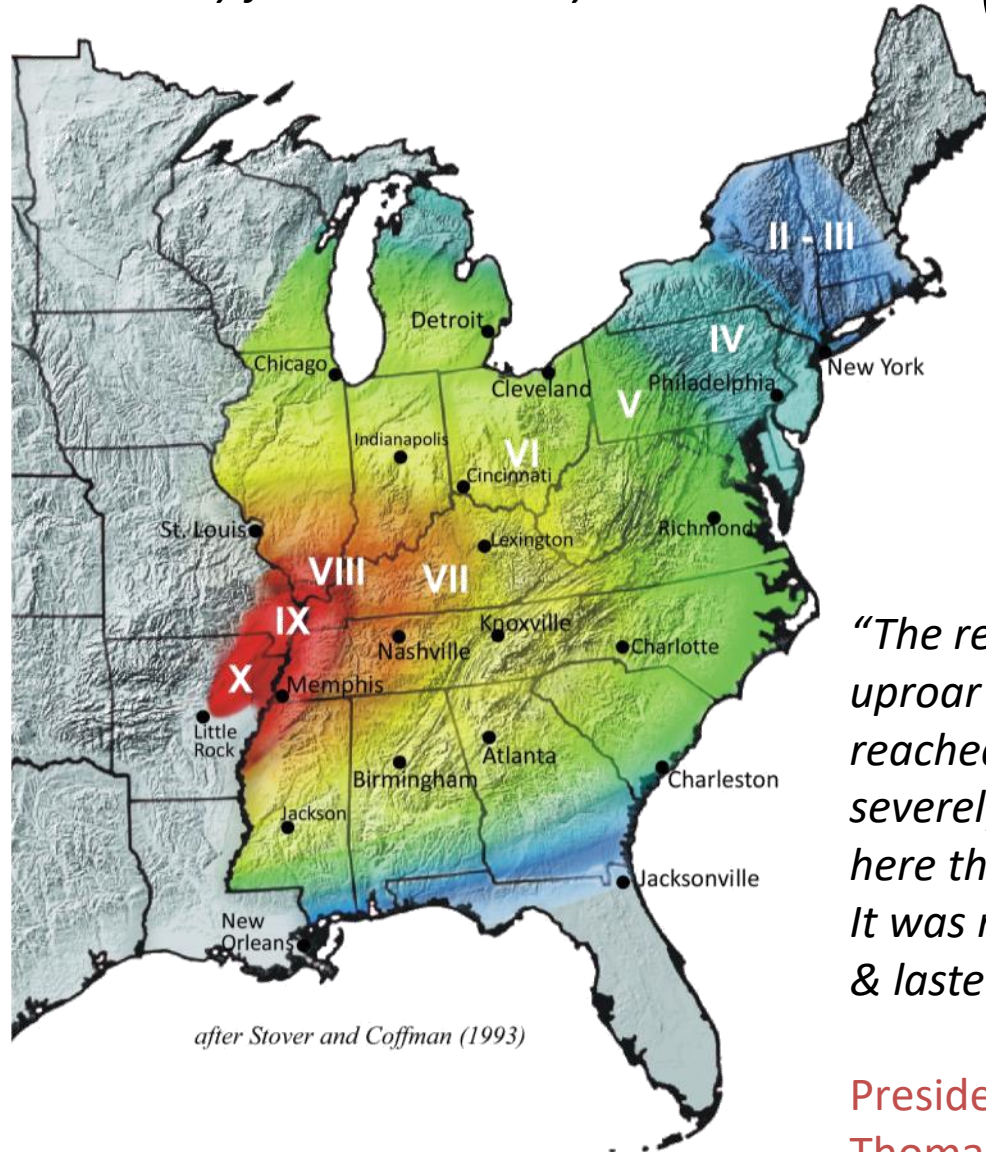
Numerous reports of landslides, ground failures and uplifts, sand blows, etc.

- Church Bells Rang in Charleston, SC.
- New U.S. Capitol in D.C. Damaged.
- Sidewalks Cracked in Cleveland.

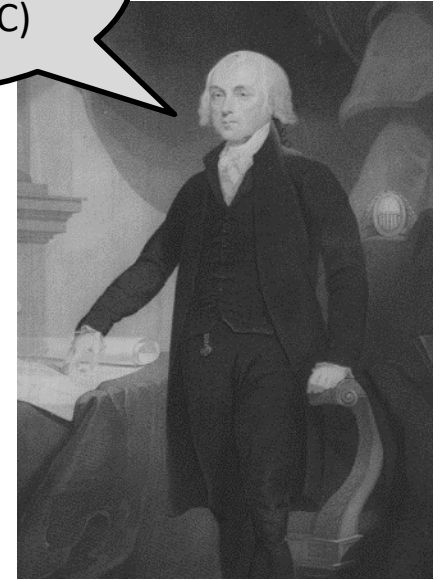
Earthquakes were felt as far away as Canada and the Caribbean.



## 1811-1812 Earthquakes – *The most widely felt in U.S. History*



I felt it  
(in Wash. DC)

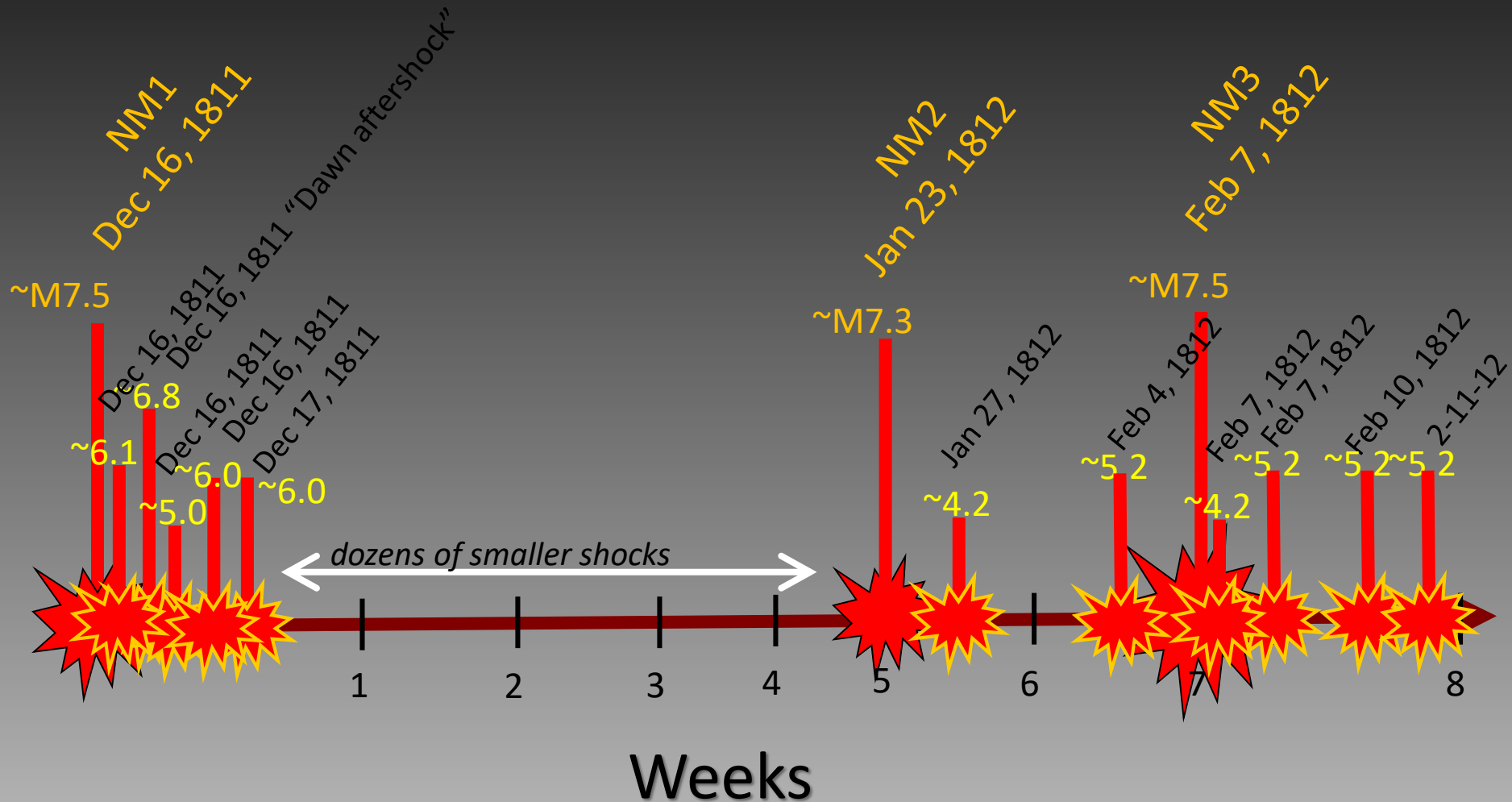


*“The re-iteration of earthquakes continues the uproar from certain quarters. They have slightly reached the state of N. Y. and have been severely felt W. & S. Westwardly. There was one here this morning at 5 or 6 minutes after 4 o’C. It was rather stronger than any preceding one, & lasted several minutes....”*

President James Madison writing to  
Thomas Jefferson, Feb 7, 1812  
(Library of Congress)

# The 1811-1812 New Madrid Sequence

3 Main shocks ~M7.3-7.5: 4 aftershocks ~M6.0-6.3



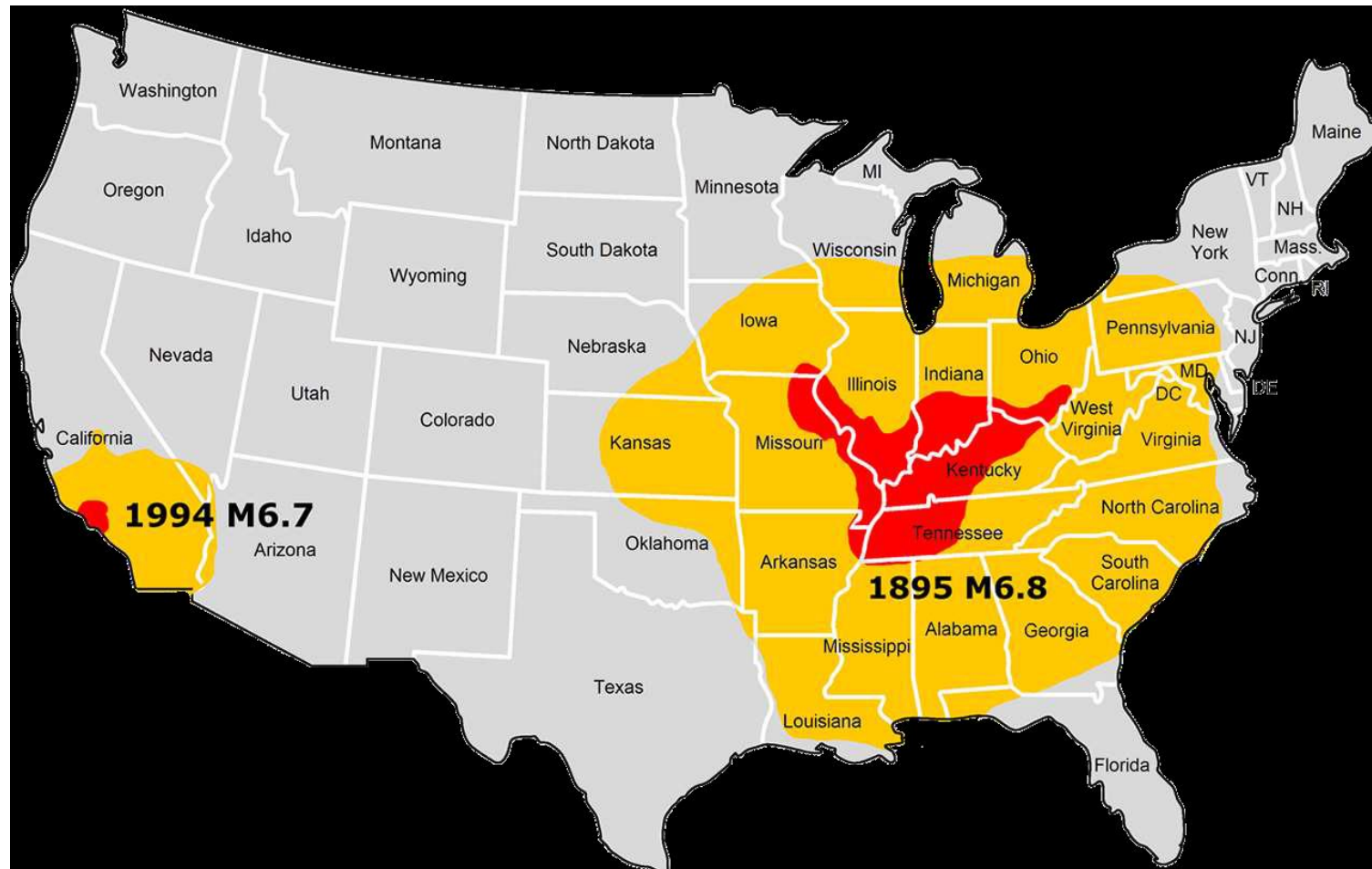
# Can't be Predicted

- Floods are slow to arrive
- Tornadoes have warnings
- Earthquakes occur without warning

# What are the odds?

- 25-40% chance of M6 or larger in 50 years
- 7-10% chance of M7 or larger in 50 years

**For similar magnitude earthquakes, shaking area is about 10 times greater in the central and eastern U.S.**



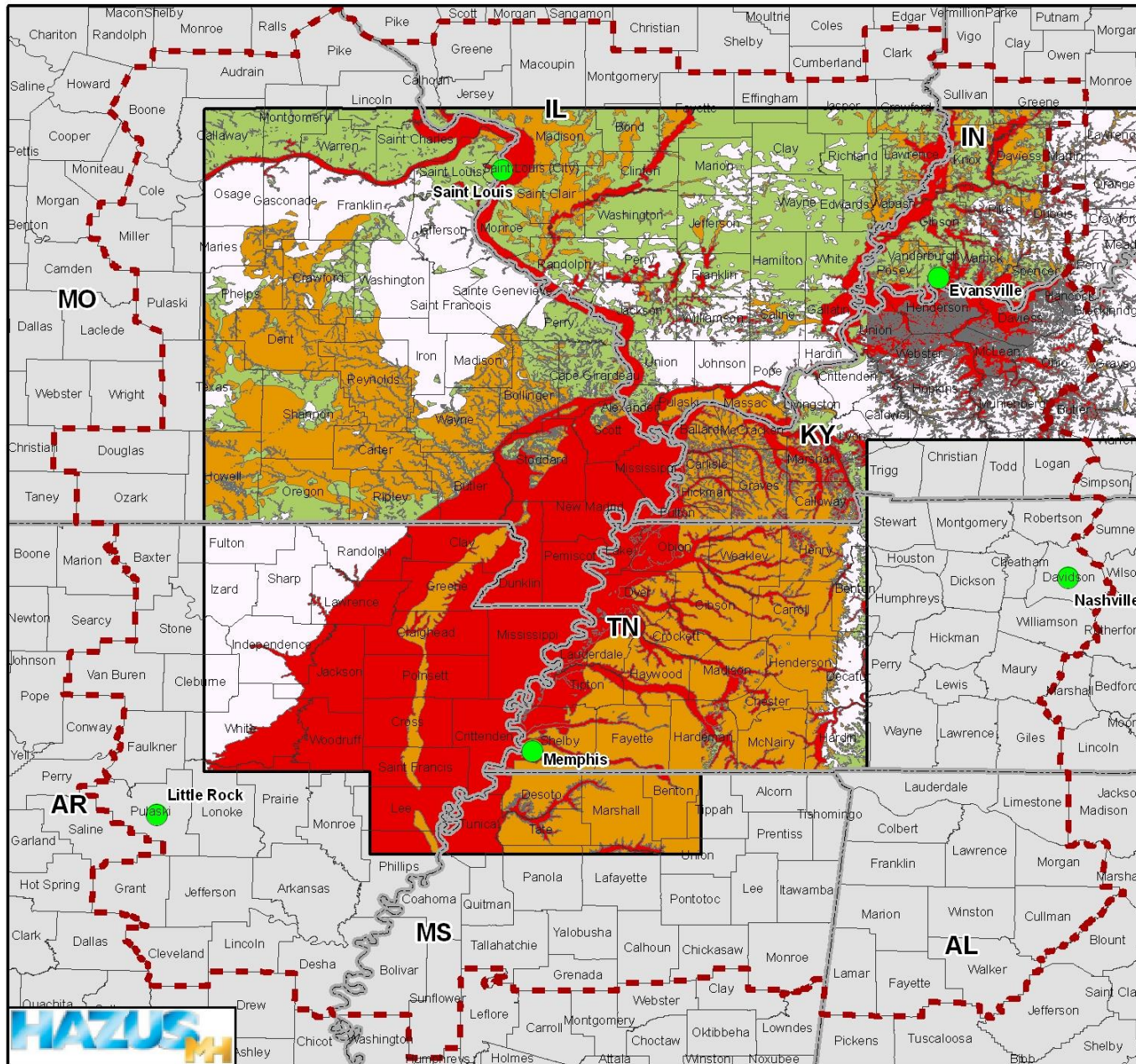








# Liquefaction Susceptibility - Earthquake Scenario: New Madrid Region



## New Madrid Scenario Magnitude 7.7

### Liquefaction Susceptibility

- None
- Very Low
- High
- Very High
- Major Cities
- Study Region Boundary
- County Boundaries
- State Boundaries



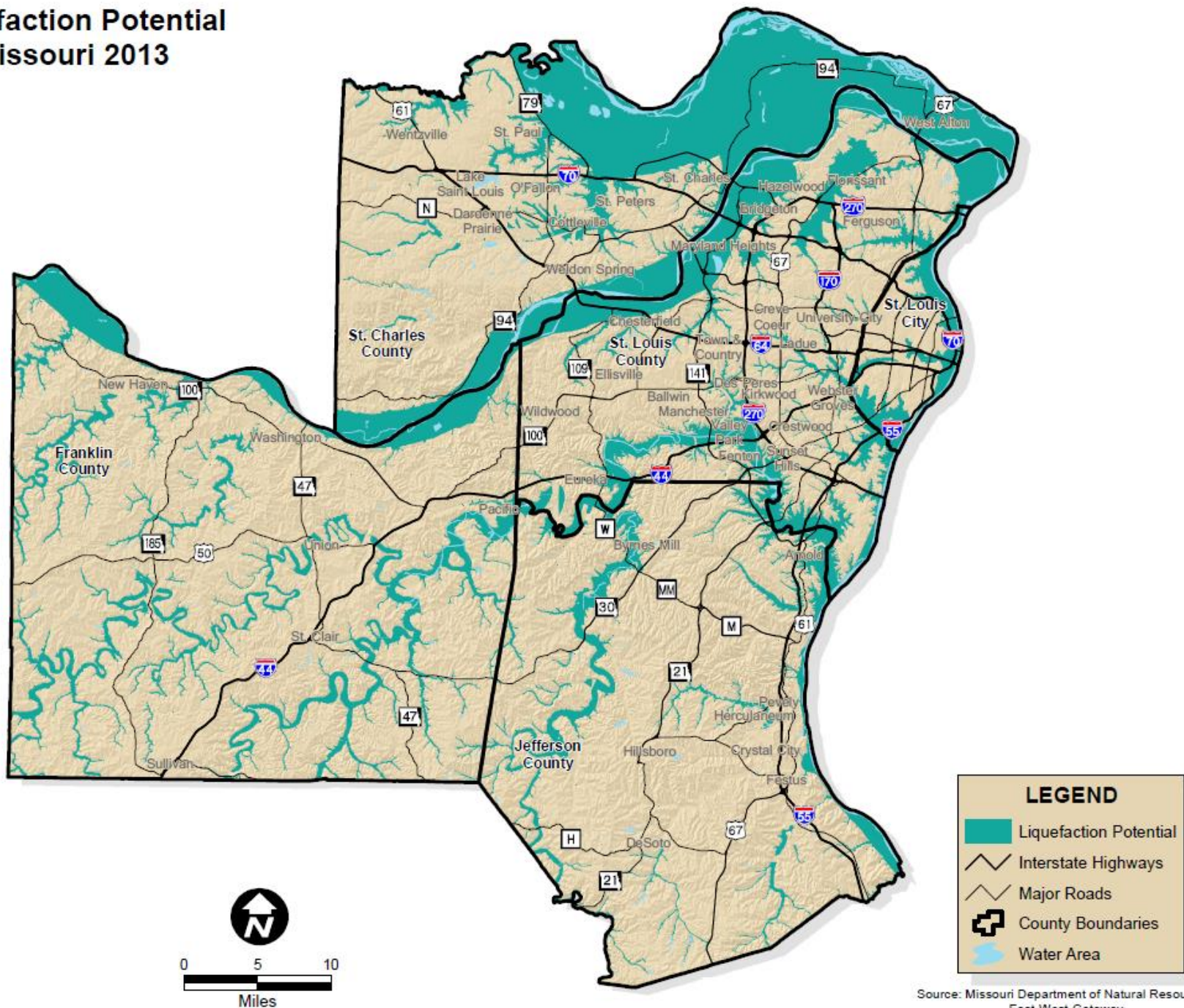
0 25 50 100 Miles

Location Map





## Liquefaction Potential Missouri 2013







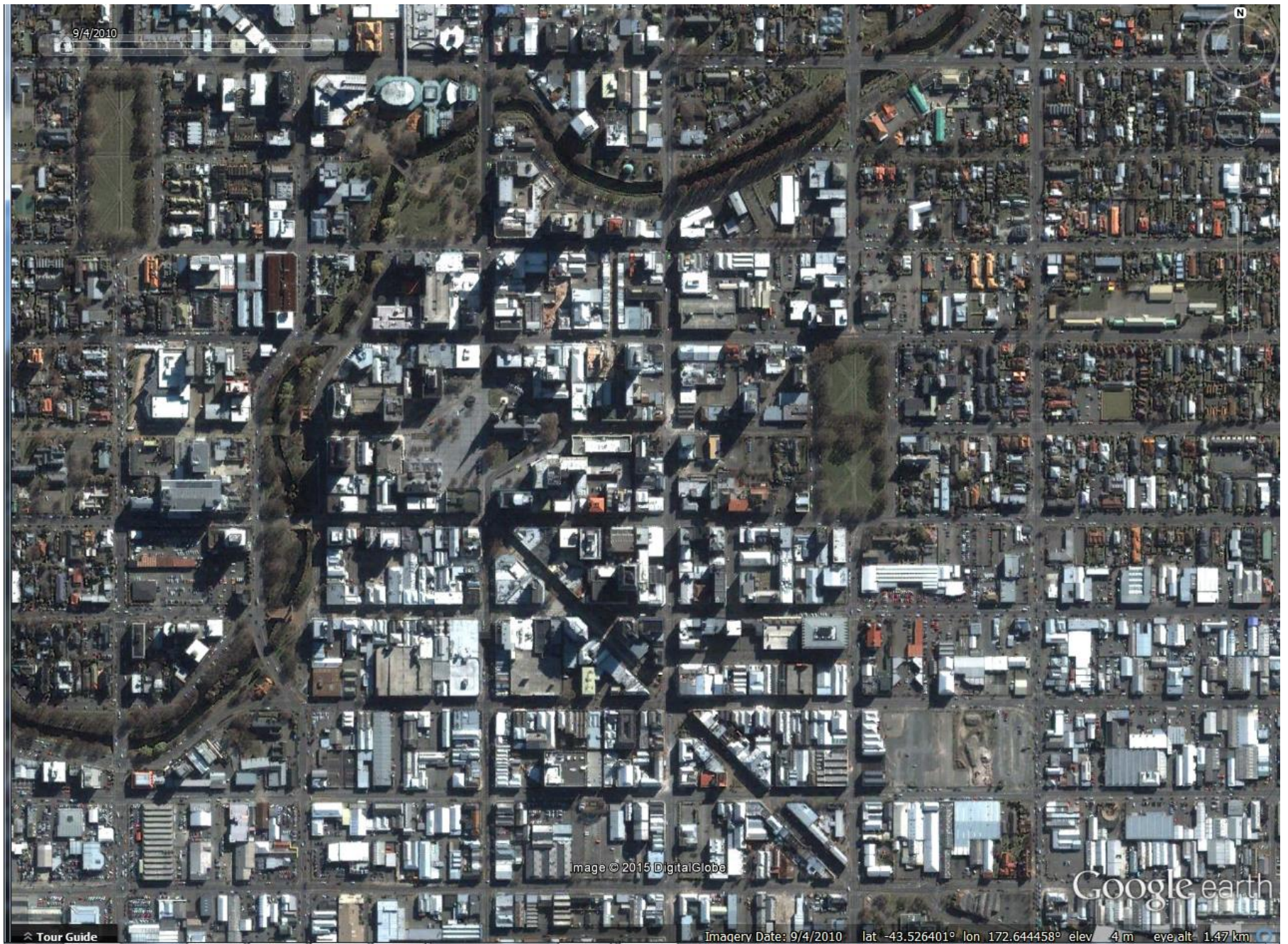








# Christchurch in 2010 - before the earthquakes





# Christchurch in 2014 - after the earthquakes



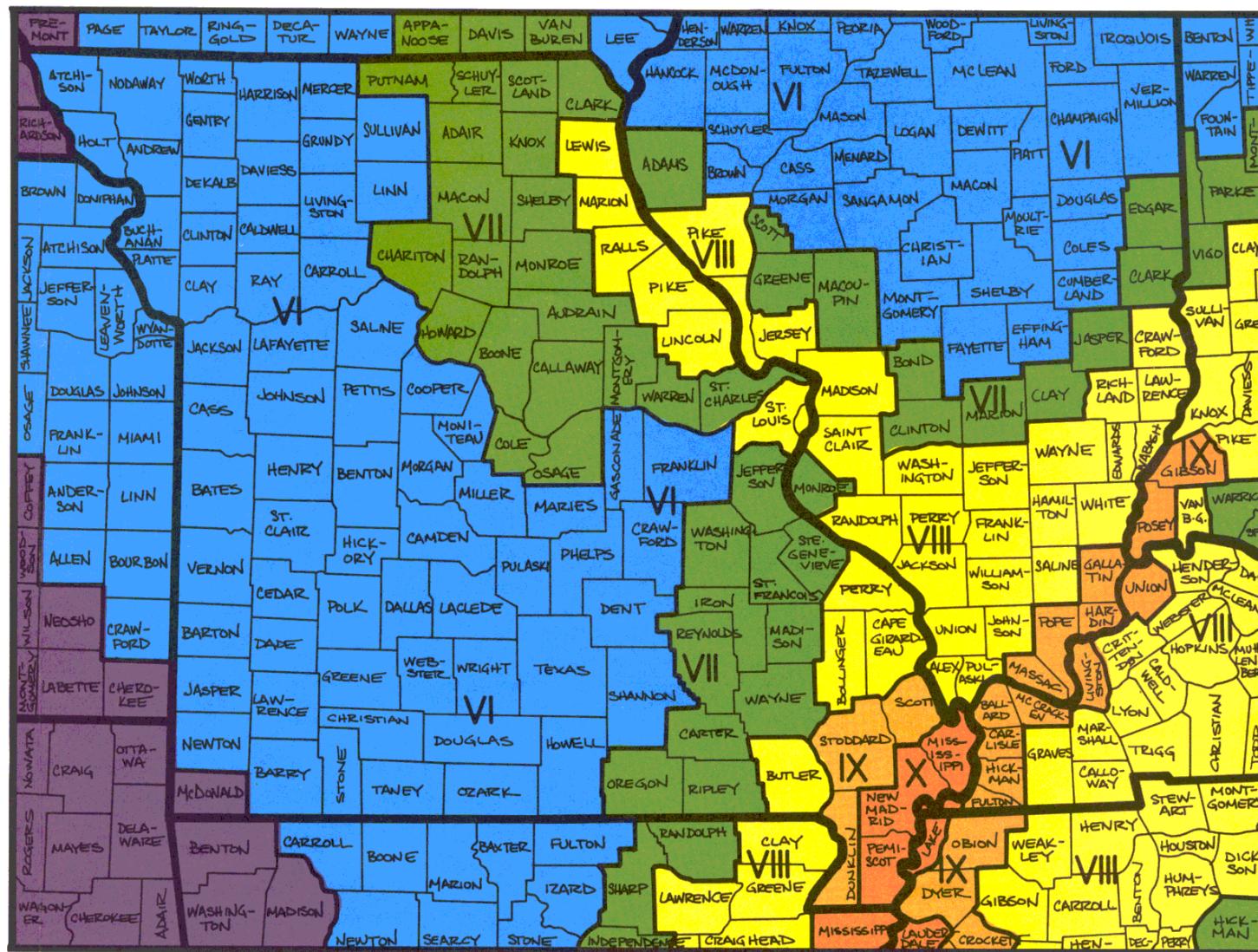
# Earthquake insurance

- Most homeowners DO NOT have it
  - **Only 20% in NMSZ in Missouri**
- Must be purchased separately – called an “endorsement”
- Prices and deductibles have increased, especially in high-impact areas
- Check with your insurance agent





## PROJECTED EARTHQUAKE INTENSITIES



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

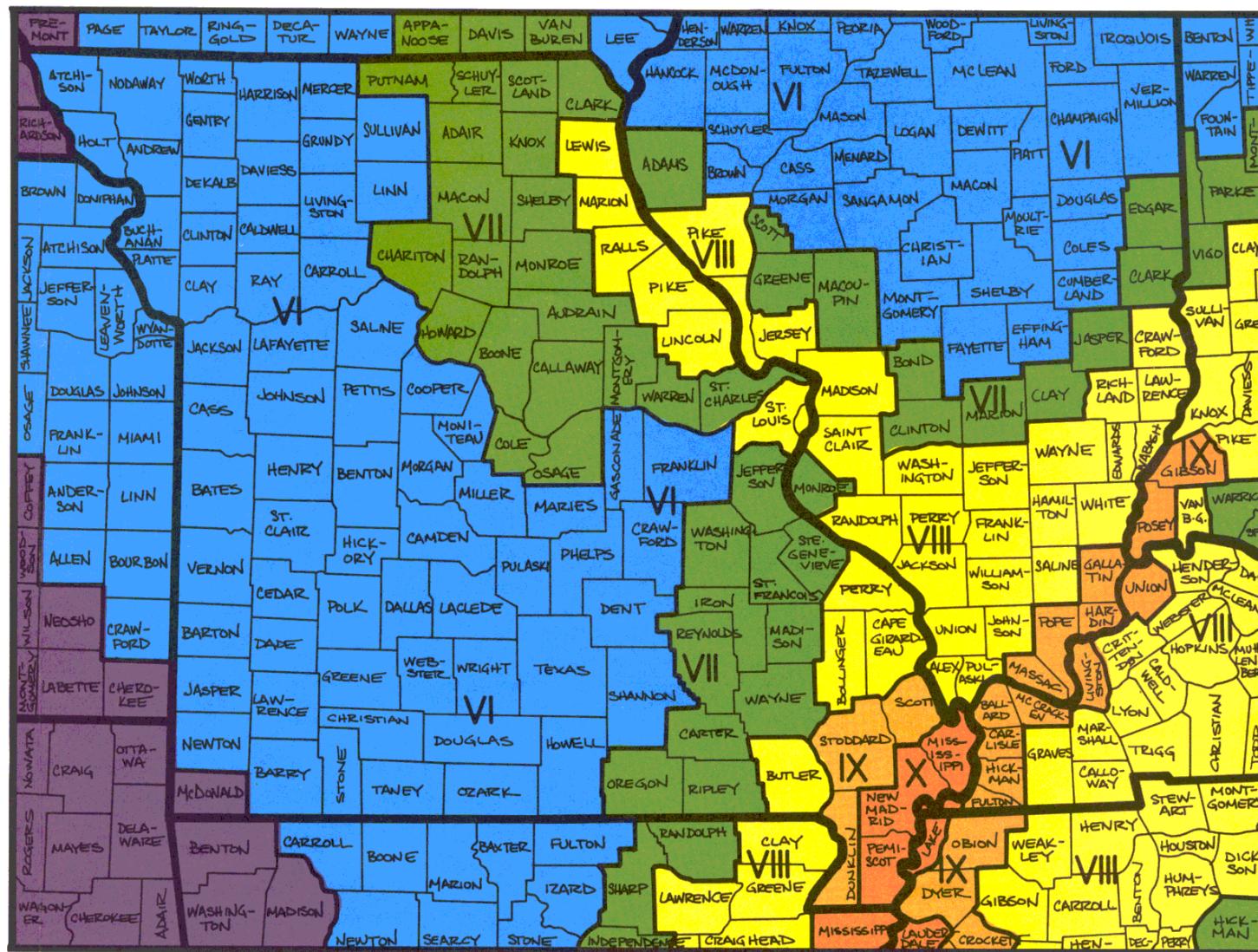


# Shaking Intensity 6





## PROJECTED EARTHQUAKE INTENSITIES



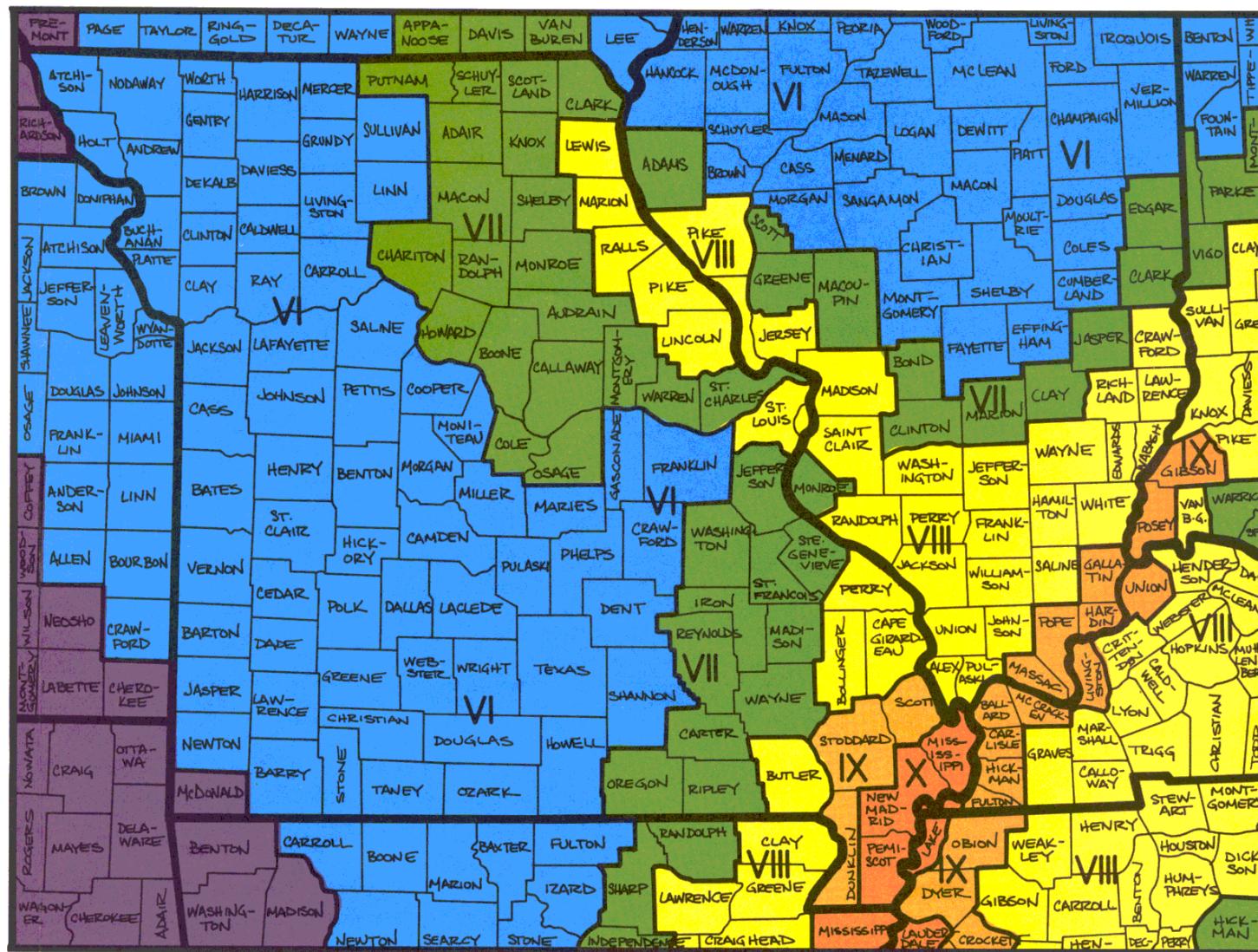
This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



# Shaking Intensity 7







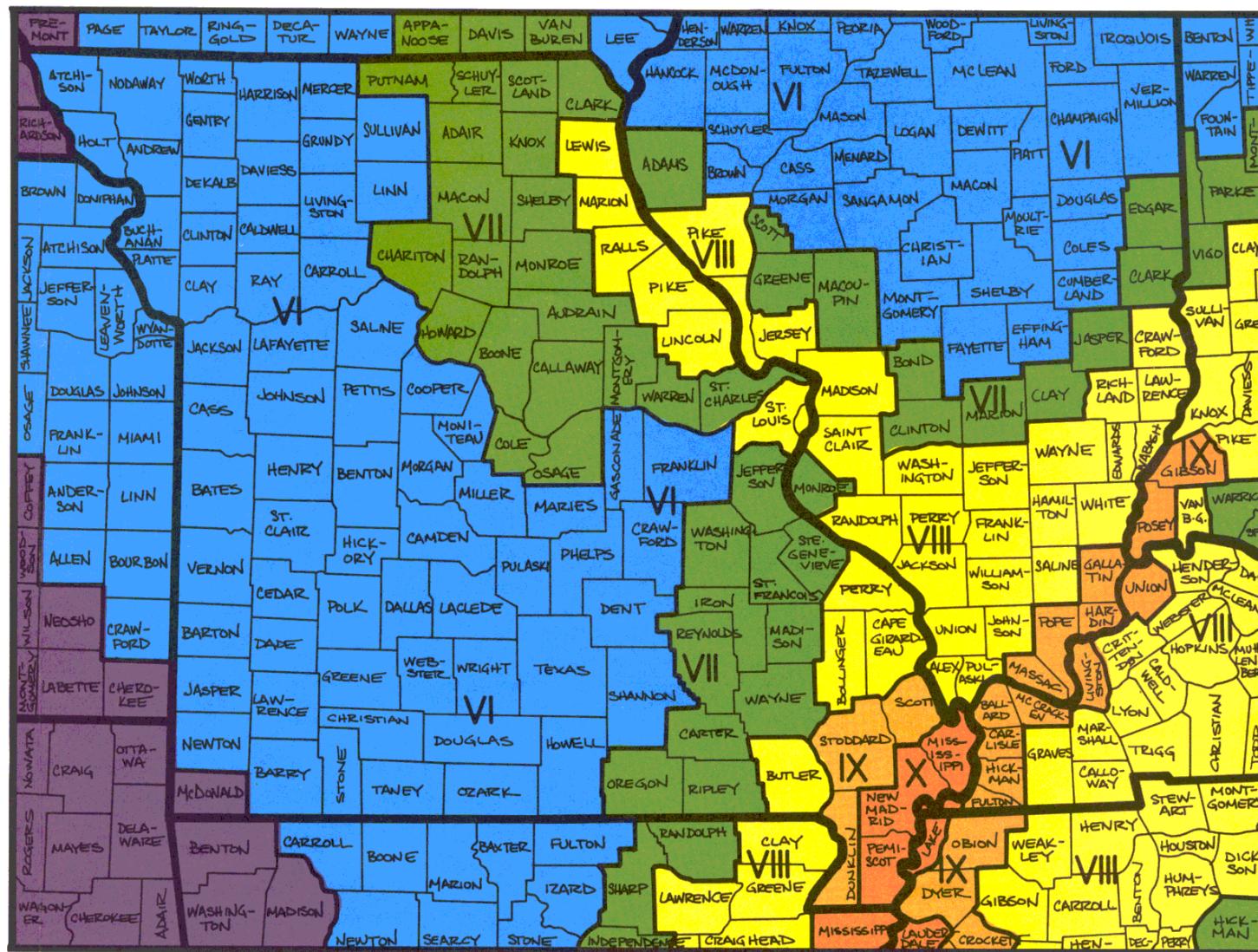
This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

# Shaking Intensity 8





## PROJECTED EARTHQUAKE INTENSITIES



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

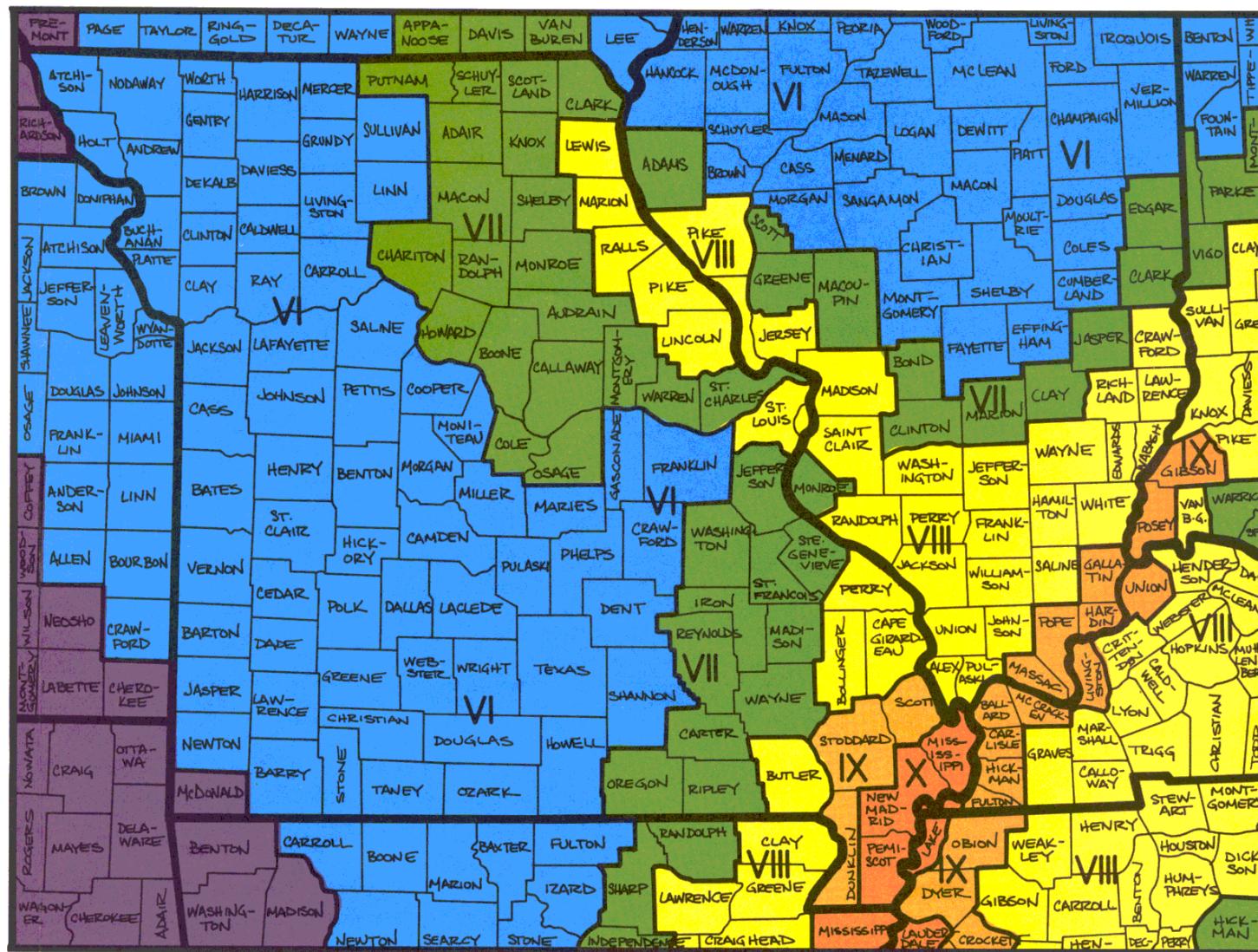


# Shaking Intensity 9





## PROJECTED EARTHQUAKE INTENSITIES



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



# Shaking Intensity 10+

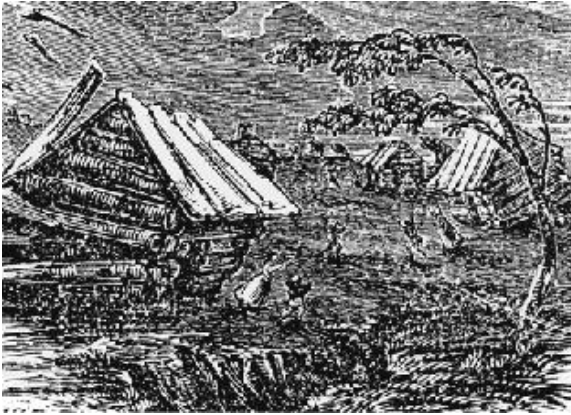






- Fault uplifted downstream land surface
- Natural dam
- Backflow created Reelfoot Lake
- Channel soon reclaimed
- Evidence still visible today

# 1811-1812 New Madrid Sequence



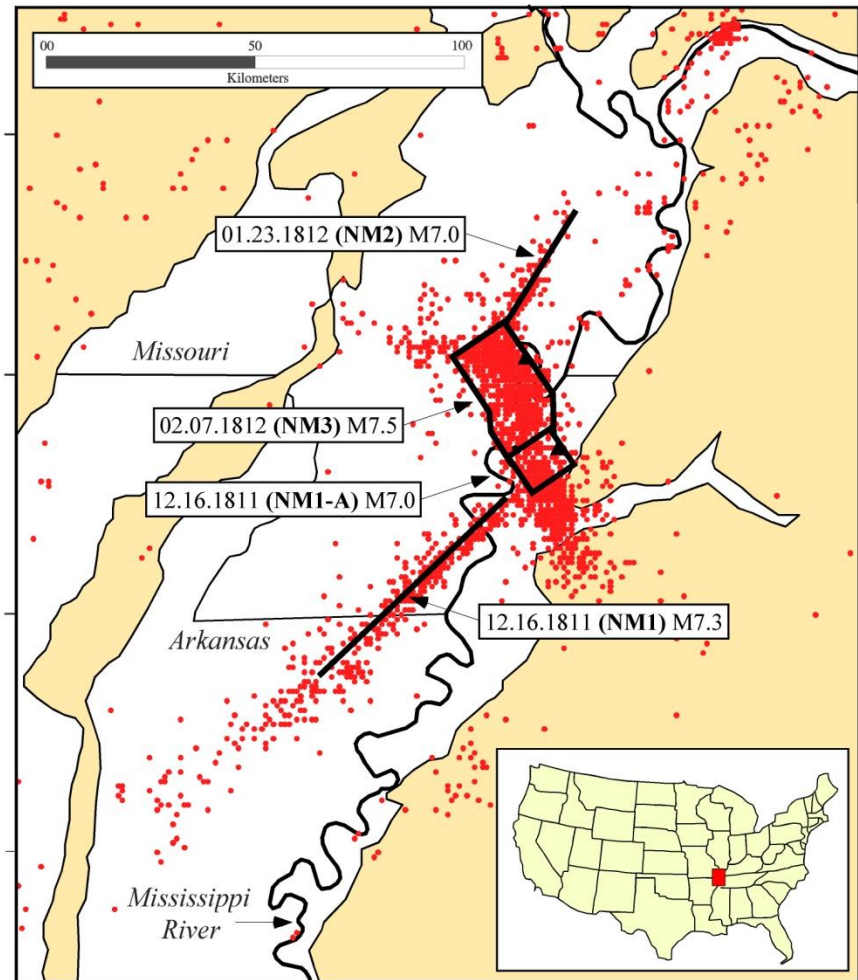
**Four  $M > 7.0$  earthquakes:**

**Dec. 16, 1811 (2:15 AM)**

**Dec. 16, 1811 ('dawn')**

**Jan. 23, 1812 (9:00 AM)**

**Feb. 7, 1812 (3:45 AM)**



Source: J. David Rogers, Ph.D., P.E., P.G.  
Missouri University of Science & Technology



# Estimated 8 State Impact

*HAZUS Report based on a 7.7 M earthquake occurring in the New Madrid Seismic Zone*

## Casualties

Injuries

82,269

Fatalities

3,496

## Infrastructure Damages

Buildings Damaged

713,200

Bridge Damage

3,547

Airport Facility Damage

143

Port Damage

232

Railway Bridge Damage

29

Damage to Dams

327

Damage to Levees

96

Hazmat Facility Damage

253

Debris Generated (tons)

50 million

## Critical Facility Damages

Hospitals

129

Schools

1,322

Fire Stations

729

Police Stations

379

## Impacts (Day 1)

Households w/out Power

2.6 million

Households w/out Water

1.1 million

## Economic Losses

Buildings

\$113 billion

Transportation

\$11 billion

Utilities

\$172 billion

**Total**

**\$296 billion**

# Other Costly Disasters

1994 – Northridge, CA Earthquake  
\$42 billion      60 deaths

2005 – Hurricane Katrina  
\$108 billion    1,800 deaths

2011 – Christchurch, NZ Earthquake  
\$26 billion      181 deaths

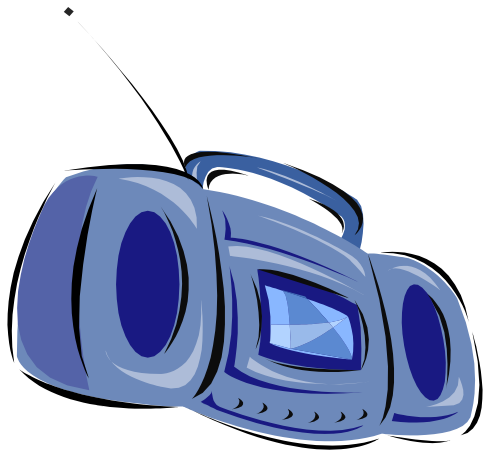
2012 – Superstorm Sandy  
\$50 billion      286 deaths





# Prepare BEFORE an earthquake happens

- Put together an emergency kit – flashlight, first aid kit, radio, drinking water, blankets
- Develop a family communication plan – identify a relative living at least 100 miles away; everyone can call to “check in” to tell family you’re safe
- Secure water heater, tall furniture, move heavy objects to lower shelves
- Know how to turn off utilities



# How to Protect Yourself During an Earthquake



- If inside, stay inside!
- If outside, stay outside!
- **Drop** to the floor
  - before the earthquake drops you!



- **Take Cover**
  - under a sturdy desk or table
  - Or get down next to a wall and cover your head with your arms



- **Hold On** to it firmly
  - Be ready to move with it until the shaking stops.

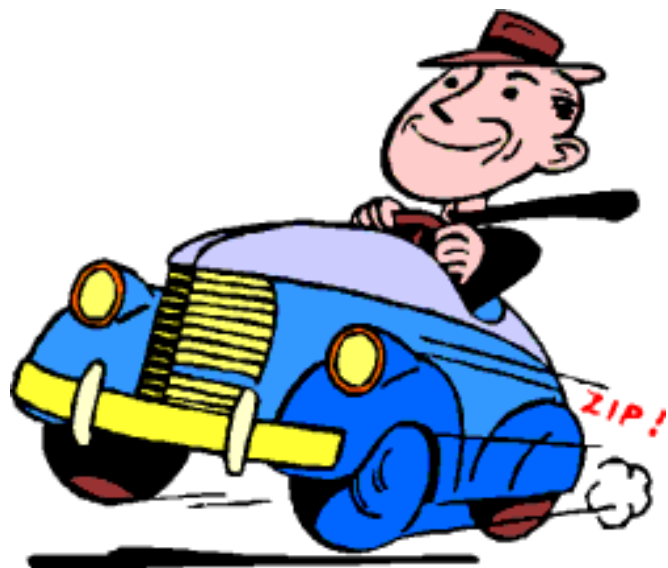


# An Insider's View: The Loma Prieta Earthquake Revisited

Earthquake Engineering Laboratory  
October 10, 2014



University of Nevada, Reno



If you're driving, pull off the road, away from buildings and utility poles, and stay in your car.

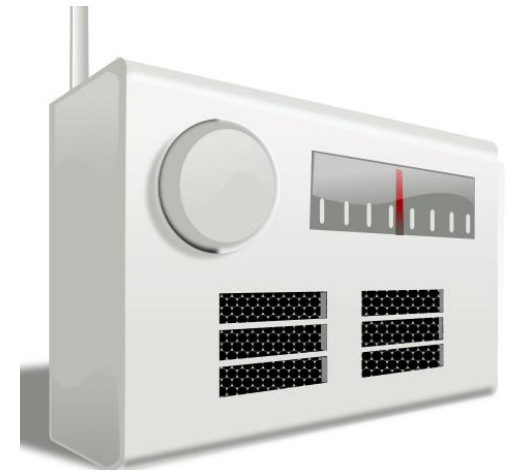
If you're outside, drop to the ground, away from large objects, and cover your face and head with your arms.





# After the quake hits:

1. Find your family; check for injuries
2. If necessary, call 911 for help
3. If you smell gas or hear a hissing sound, go outside – shut off gas valve
4. Be careful to avoid live power lines and broken glass
5. Listen to news for latest emergency information
6. Be ready for aftershocks!



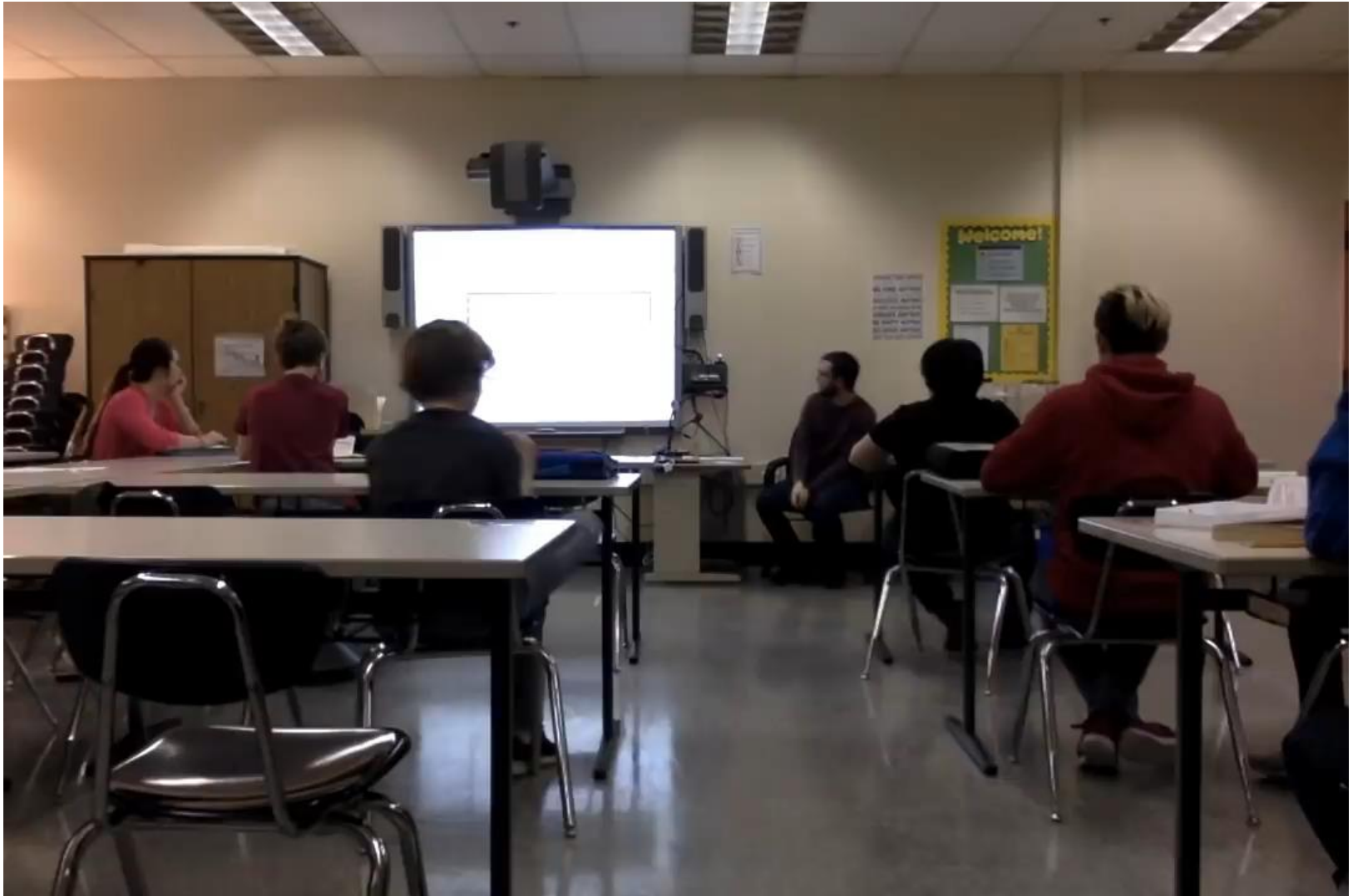
# Great Central U.S. ShakeOut

- About 3 million people in 14 states participated in “Drop, Cover and Hold On” earthquake drill
- More than 500,000 participated in Missouri
- **Sign up at [shakeout.org](http://shakeout.org)**





Anchorage, Alaska  
November 30, 2018



# ***Thank You!***

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- E-Mail: [jeff.briggs@sema.dps.mo.gov](mailto:jeff.briggs@sema.dps.mo.gov)

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